

CLAIMS

Sub B

1. An interactive method for allowing a user to obtain image data for diagnostic purposes
 5 from a server having access to stored data, comprising:

connecting a user's computer to the server over a communication network;
 receiving from the server image reconstruction software for the user's computer;
 requesting specific image data for transmission from the server to the user's computer;
 progressively transmitting the requested specific image data over the network from the

10 server to user's computer; and

reconstructing a diagnostic quality image, from the progressively received image data,
 using the reconstruction software on the user's computer.

15 2. A method according to claim 1, comprising image processing said reconstructed image
 using said reconstruction software on said user's computer.

3. A method according to claim 1, comprising:
 receiving from the server image selection software for the user's computer,
 wherein said image selection software is used for said requesting.

20 4. A method according to claim 3, wherein said image selection software controls the
 transmission of the image data.

25 5. A method according to claim 3, wherein said image selection software displays images
 from said server.

6. A method according to claim 3, wherein said image selection software and said
 reconstruction software are received together.

30 7. A method according to claim 3, wherein said image selection software and said
 reconstruction software comprise a single software unit.

8. A method according to claim 3, wherein said image selection software is operative to stop the transmission of the data, after at least a low quality image is reconstructed and viewed from said data.

5 9. A method according to claim 8, wherein said image selection software is operative to restart the transmission of the data of the entire image, after said stopping.

10. A method according to claim 3, wherein said image selection software controls processing of data at said server, prior to its transmission.

10 11. A method according to claim 10, wherein said processing comprises reducing said data from a large bit-per-pixel ratio to a small bit per pixel ratio, independently of details of said request, except an identification of the data requested.

15 12. A method according to claims 10, comprising interactively providing user input to said image selection software, to affect said control.

13. A method according to claim 3, wherein said image selection software controls said server to selectively transmit only portions of the image data.

20 14. A method according to claim 3, wherein the image selection software comprises application software coded using a device independent network programming language.

25 15. A method according to claim 3, wherein the reconstruction software comprises application software coded using a device independent network programming language.

16. A method according to claim 14, wherein said language comprises Java.

17. A method according to claim 14, wherein said language comprises ActiveX.

30 18. A method according to claim 1, wherein reconstructing comprises:
reconstructing images of progressively improving quality from the progressively received data;

using the produced improved images of progressively produced quality to decide on processing of the images, wherein said processing comprises gray-level windowing; and processing said images, prior to the progressively received data being completely received.

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19. A method according to claim 1, wherein reconstructing comprises:

reconstructing images of progressively improving quality from the progressively received data;

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using the produced improved images of progressively produced quality to decide on processing of the images; and

interactively selecting regions of interests in the images based on said progressively improved images, prior to the progressively received data being completely received.

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20. A method according to claim 1, wherein said data is progressively transmitted while a lower quality image is being reconstructed from said data.

21. An interactive method for allowing a user to obtain image data for diagnostic purposes from a server having access to stored data, comprising:

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connecting a user's computer to the server over a communication network;
requesting specific image data for transmission from the server to the user's computer;
progressively transmitting the requested specific data over the network to the user's computer;

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reconstructing images of progressively improving quality from the progressively received data;

using the produced improved images of progressively produced quality to decide on processing of the images; and

interactively selecting regions of interests in the images based on said progressively improved images, prior to the progressively received data being completely received,

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wherein said data transmission continues while said regions are being selected on an image reconstructed from previously transmitted data of a lower quality.

22. A method according to claim 21, wherein said image data represents a set of images and wherein using the produced images to decide comprises using the produced images to decide on processing images which have not yet been received.

23. A method according to claim 21, comprising deciding on a termination of transmission of said progressive image data, responsive to a decision based on said reconstructed images.

24. A method according to claim 21, wherein said processing comprises converting said image data to image data representing an image with fewer bits per pixel, which fewer bits represent a gray scale component of said image, wherein said converting does not affect the number of pixels in said image.

25. A method according to claim 21, wherein said processing comprises selecting a region of interest of said images.

26. A method according to claim 21, wherein said processing said images is performed on said image data, at said server, prior to their being transmitted to said user's computer.

27. An interactive method for allowing a user to obtain image data for diagnostic purposes from a server having access to stored data, comprising:
connecting a user's computer to the server over a communication network;
requesting specific image data for transmission from the server to the user's computer;
reducing the bit-per-pixel ratio of parts of the data being transmitted, responsive to said request, which fewer bits represent a gray scale component of said image, wherein said converting does not affect the number of pixels in said image; and
transmitting the reduced data.

28. A method according to claim 27, wherein said reduction in bit-per-pixel ratio is performed responsive to user input at said user's computer.

29. A method according to claim 28, wherein said user input comprises selection of an image portion.

30. A method according to claim 11, wherein reducing the bit-per-pixel ratio comprises calculating an average "M" of the gray values in the image and a standard deviation "S" of said gray values; and
rescaling these values in the range $[(M-S/2)..(M+S/2)]$ to obtain a new lower number of
5 bits per pixel.

31. A method according to claim 11, wherein reducing the bit-per-pixel ratio comprises:
estimating the mean and standard deviation of the gray levels locally; and
rescaling these values to obtain a new lower number of bits per pixel.

32. A method according to claim 1, wherein progressively transmitting the requested data
over the network comprises:

recomposing the image into a pyramidal structure comprised of layers, said layers
ranging sequentially from a layer having the least amount of data to a layer having the most
15 data; and

transmitting the layers making up the pyramid individually starting with the layer with
the least amount of data to enable the user to view the progressively improving image to
decide on further transmission of the image.

33. A method according to claim 32, wherein recomposing the image into a pyramidal
structure comprises reducing the image to provide the different layers at the transmitting end
for progressive transmittal.

34. A method according to claim 33, wherein reducing comprises discarding alternate rows
25 and columns to create an image that is a quarter of the size of the original image.

35. A method according to claim 32, comprising:
providing a first layer with reduced resolution in the pyramidal structure;
providing remaining layers that contain residual values with increased resolution; and
30 progressively receiving the data used to provide images based on the received data of
progressively improved resolution.

36. A method according to claim 1, comprising:

compressing the requested data transmitted over the network; and
decompressing the received required data to provide images.

37. A method according to claim 36, wherein compressing comprises spatially
5 decorrelating the data by predicting each pixel at the current resolution using its spatial casual
neighbors.

38. A method according to claim 36, wherein compressing comprises temporally
10 decorrelating each pixel by predicting each pixel value at the current resolution using the
values of temporal neighbors from previous images.

39. A method according to claim 38, wherein a predictor X used in predicting each pixel
value for a single image is equal to $f(a, b, c)$, wherein a, b and c are previously predicted
neighboring pixels.

40. A method according to claim 38, wherein a predictor X used in predicting each pixel
value for a group of images equals $f(a, b, c, a1, b1, c1, x1)$ wherein a, b and c are previously
predicted neighboring pixels in a same image and a1, b1, c1 and x1 are corresponding pixels in
a previously predicted image of the image group.

41. A method according to claim 36, wherein said compressing and said decompressing
use entropy coding and decoding respectively.

42. A method according to claim 41, wherein said entropy coding and decoding are
25 accomplished using Golomb Rice entropy coding and decoding.

43. A method according to claim 35, comprising using adaptive slicing and entropy coding
and decoding of each slice for progressively transmitting the requested specific image data,
wherein said entropy coding generates a residual matrix.

44. A method according to claim 43, wherein using adaptive slicing comprises:
30 scanning the obtained residual matrix into a residual vector; and

partitioning the residual vector into variable length sub vectors with a relatively homogeneous probability distribution function.

45. A method according to claim 44, wherein partitioning comprises:

estimating the local mean and variance on the sub-vector;

sectioning the vector on high transients; and

coding each sub vector separately.

46. A method according to claim 44, wherein said compression does not increase the size of said data.

47. A method according to claim 1 wherein connecting the user computer to the server over a communication network comprises connecting over the Internet.

48. A method according to claim 1 wherein connecting the user computer to the server over a communication network comprises using a dial up communication system.

49. A method according to claim 1 wherein connecting the user computer to the server over the communication network comprises using networking facilities.

50. A method according to claim 1, wherein the stored data comprises data for a plurality of "postage stamp" images.

51. A method according to claim 50, comprising using "postage stamp" images as a catalog for selecting those images for which no further data is to be transmitted and those images for which further data is to be transmitted.

52. A method according to claim 50, wherein said postage stamps comprise a lowest level in a pyramidal representation of said images.

53. A method according to claim 1, wherein progressively transmitting comprising serially transmitting a sequence of images of increasing resolution, each image being progressively transmitted.

54. A method according to claim 1, wherein progressively transmitting comprising transmitting data operative to reconstruct images of increasing resolution.

5 55. A method according to claim 1, wherein progressively transmitting the requested data over the network comprises segmenting an image into background parts and tissue parts, and transmitting the tissue parts first.

10 56. An interactive method for allowing a user to obtain image data for diagnostic purposes from a server having access to stored data, comprising:
connecting a user's computer to the server over a communication network;
segmenting an image into background parts and tissue parts; and
transmitting the tissue parts first.

15 57. A method according to claim 56, comprising requesting said specific image data for transmission from the server to the user's computer.

58. The method of claim 55, comprising stopping the transmission before transmitting the background part.

20 59. The method of claim 55, comprising transmitting the background part to achieve loss-less transmission of the image.

25 60. An interactive method for allowing a user to obtain image data for diagnostic purposes from a server having access to stored data, comprising:
connecting a user's computer to the server over a communication network;
requesting specific image data for transmission from the server to the user's computer;
transmitting the requested specific image data over the network from the server to user's computer;

30 stopping said transmission at an arbitrary point, by command from a user at said user's computer, responsive to said user viewing at least one image reconstructed from said image data; and

continuing said transmission after a time, responsive to a command from said user.

61. A method according to claim 60, wherein said continued transmission is modified by said user, responsive to images reconstructed from said stopped transmission.

5 62. A method according to claim 60, wherein stopping said transmission stops compression of images at said server.

63. A method according to claim 60, wherein stopping said transmission comprises stopping said transmission after a reduced-resolution representation of the image data is
10 transmitted.

64. An interactive method for allowing a user to obtain image data for diagnostic purposes from a server having access to stored data, comprising:

connecting a user's computer to the server over a communication network;

receiving from the server image reconstruction software for the user's computer;

requesting specific image data for transmission from the server to the user's computer;

transmitting the requested specific image data over the network from the server to

user's computer; and

reconstructing a diagnostic quality image, from the image data, using the

20 reconstruction software on the user's computer.